

Climate Change and Sea Level Trends for Planning at Cape Lookout National Seashore

Patrick Gonzalez

National Park Service

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Historical Trends

During the 20th century, temperature has increased across North America (Figure 1) and in the 50 km x 50 km area that includes Cape Lookout National Seashore (NS) (Figure 2, Table 1). Precipitation has increased across the southeastern U.S. (Figure 3), but decreased slightly in the area including the park (Figure 4). The temperature and precipitation trends are not statistically significant for the Cape Lookout NS area. Sea level at Wilmington, North Carolina has shown a statistically significant increase since the installation of the tidal gauge in 1935 (Figure 5). Analyses of causal factors attribute 20th century global temperature, precipitation, and sea level changes to greenhouse gas emissions from vehicles, power plants, deforestation, and other human activities (Intergovernmental Panel on Climate Change (IPCC) 2007).

Future Projections

IPCC has coordinated research groups in projecting possible future climate under defined greenhouse gas emissions scenarios (IPCC 2007). Current global emissions are at or above IPCC emissions scenario A2. For the three main IPCC emissions scenarios, temperature could substantially (Table 1). Precipitation projections do not consistently show increases or decreases across emissions scenarios. In addition, projections downscaled to 4 km x 4 km indicate that, for the area of the park, some of the General Circulation Models (GCMs) project increases in precipitation for IPCC emissions scenario A2, while others project decreases (Figure 6; data from Conservation International using method of Tabor and Williams (2010)). Sea level projections (IPCC 2007) indicate increases in the rate of sea level rise (Table 1).

References

- Gonzalez, P., R.P. Neilson, J.M. Lenihan, and R.J. Drapek. 2010. Global patterns in the vulnerability of ecosystems to vegetation shifts due to climate change. *Global Ecology and Biogeography* 19: 755-768.
- Intergovernmental Panel on Climate Change (IPCC). 2007. *Climate Change 2007: The Physical Science Basis*. Cambridge University Press, Cambridge, UK.

Mitchell, T.D. and P.D. Jones. 2005. An improved method of constructing a database of monthly climate observations and associated high-resolution grids. *International Journal of Climatology* 25: 693-712.

Tabor, K. and J.W. Williams. 2010. Globally downscaled climate projections for assessing the conservation impacts of climate change. *Ecological Applications* 20: 554-565.

Table 1. Cape Lookout National Seashore climate and sea level trends. Historical and projected climate (mean \pm standard deviation (SD)) for the 50 km x 50 km square area that includes the park (Mitchell and Jones 2005, IPCC 2007, Gonzalez et al. 2010), historical sea level at Wilmington, North Carolina, (data National Oceanic and Atmospheric Administration), and projections of global mean sea level from (IPCC 2007).

	mean	SD	units
Historical			
temperature 1901-2002 annual average	15.1	0.6	°C
temperature 1901-2002 linear trend	0.3	0.02	°C/century
precipitation 1901-2002 annual average	920	190	mm/year
precipitation 1901-2002 linear trend	~0	<0.1	%/century
sea level 1935-2010 linear trend (Wilmington)	19	1	cm/century
Projected			
IPCC B1 scenario (lower emissions)			
temperature 1990-2100	1.9	0.2	°C/century
precipitation 1990-2100	+2	1	%/century
sea level 2000-2100 (global)	28	10	cm/century
IPCC A1B scenario (medium emissions)			
temperature 1990-2100	2.8	0.3	°C/century
precipitation 1990-2100	+2	1	%/century
sea level 2000-2100 (global)	35	14	cm/century
IPCC A2 scenario (higher emissions)			
temperature 1990-2100	3.1	0.3	°C/century
precipitation 1990-2100	-2	1	%/century
sea level 2000-2100 (global)	37	14	cm/century

Figure 1.

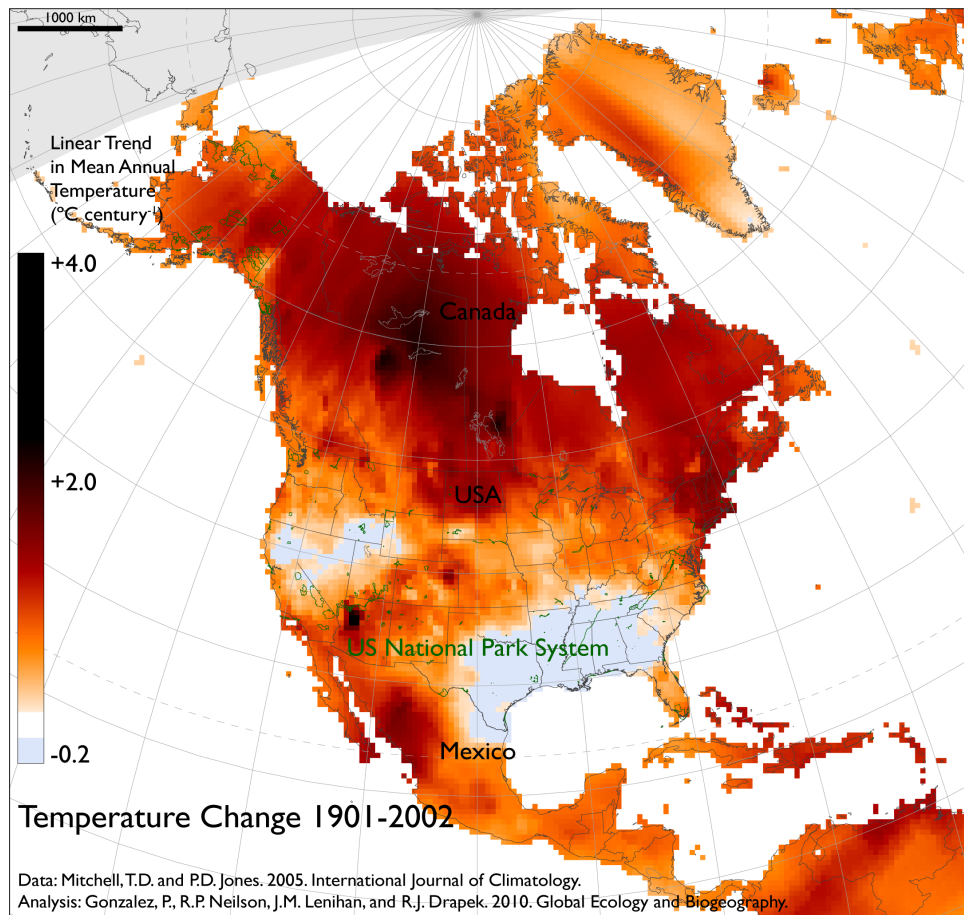


Figure 2.

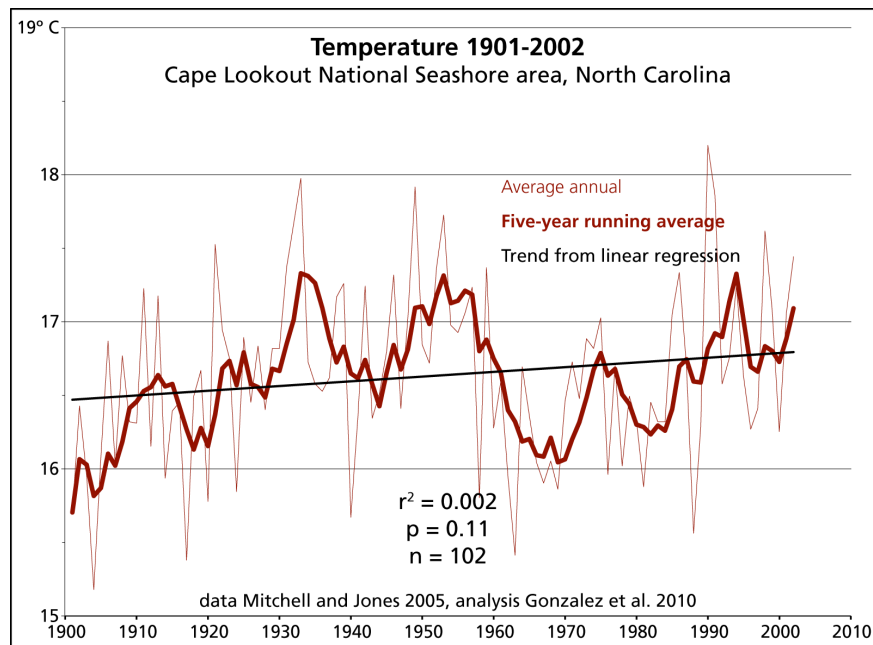


Figure 3.

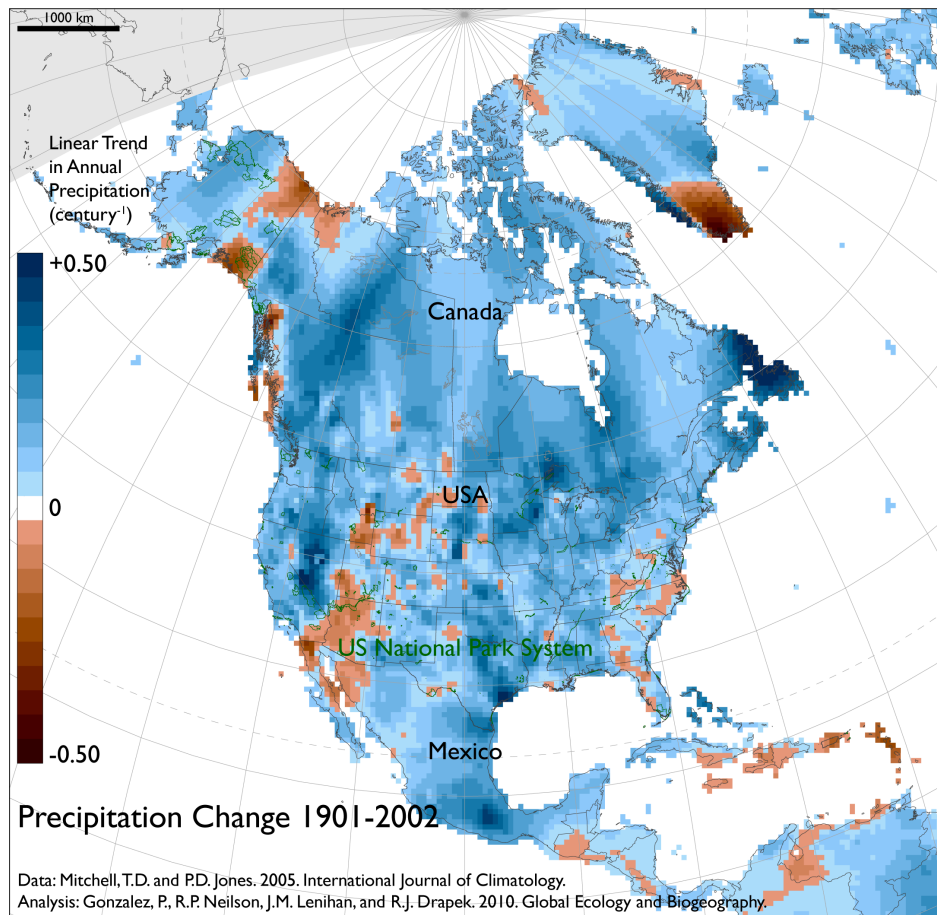


Figure 4.

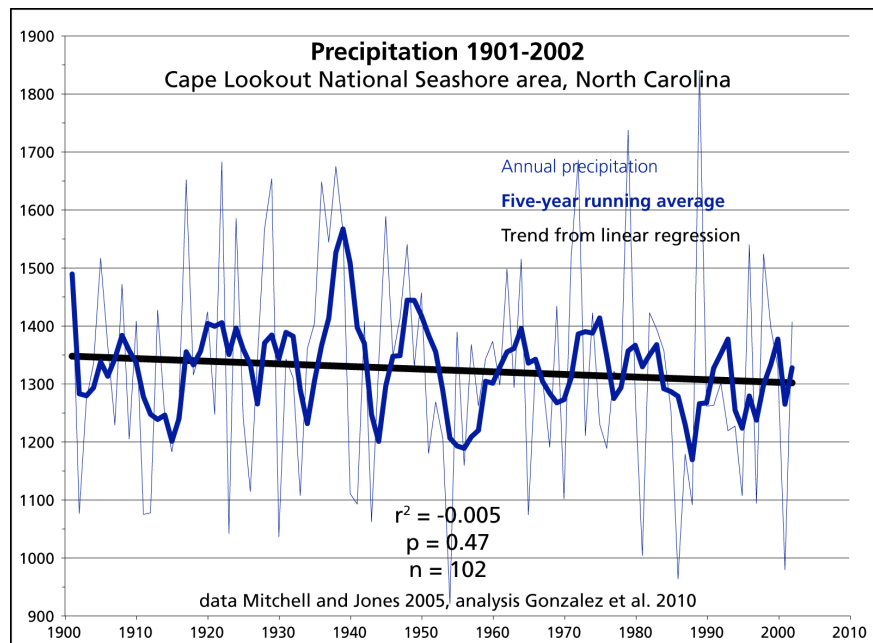


Figure 5.

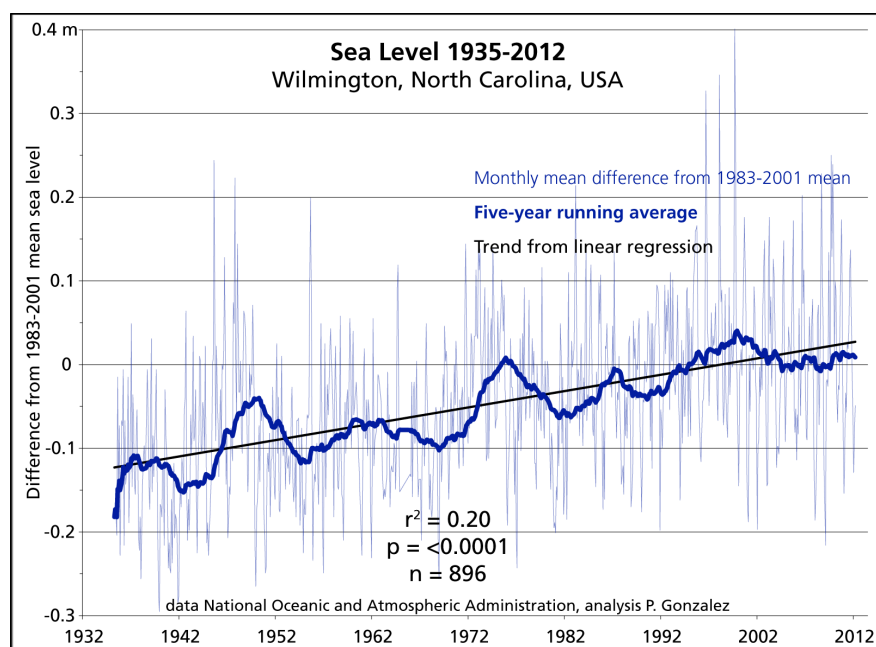


Figure 6.

